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Southern Pine Beetle Fact Sheet
Number 12

LORAN-C NAVIGATION

One of the new developments in aerial spot detection and evaluation of southern pine beetle (SPB) infestations is the Loran-C radio navigation system. Loran-C is an acronym for Long Range Aid to Navigation, and its application to beetle detection was funded partly by the U.S. Department of Agriculture's Expanded Southern Pine Beetle Research and Applications Program.

Loran-C can be used to increase the efficiency of aerial surveys, decrease the effort by ground crews in locating SPB spots that have been detected from the air, and utimately reduce survey costs. It aids in navigation and position determination during SPB surveys and can perform a variety of other forest-related applications as well.

Loran-C is a pulsed, low-frequency, hyperbolic, radio navigation aid that uses synchronized signals from three or more Loran ground stations to obtain a position fix. A master ground station transmits the signal. Two or more secondary transmitting stations receive the signal and use it to synchronize their transmitters. At the proper time interval, each transmits a signal which is received in the aircraft. These signal characteristics permit the equipment to be used in the air and on the ground at great distances (1,200 mi) from the transmitting station. Loran-C can compute the position, with an update twice every second.

The Loran-C system enables a pilot and survey crew to determine their positions accurately and also to resurvey the same areas with precision. Navigation to a waypoint for which the coordinates have been obtained from a map may provide a position accuracy within a fourth of a mile (.4 km) of the waypoint. But once the actual Loran coordinates for the waypoint position have been obtained, the return accuracy of the navigational display may be within as little as 50 feet (15.2 m).

The Loran-C receiver can be interfaced with an onboard navigational computer which provides aircraft guidance and conversion of Loran time-difference coordinates into latitude and longitude.

Preparing For An Aerial Survey

After the boundaries of a survey area have been established, east/west- or north/south-oriented parallel flight lines can be drawn on the survey coverage desired. One of the flight lines should be drawn on a known line of latitude or longitude to establish a base leg with known beginning-point and end-point coordinates. The distance from the base leg to each parallel flight line is then determined in nautical miles. The parallel flight lines are "offset" left or right of the base leg, depending on which direction the line is to be flown.

A workable navigational readout requires the following:

1. **Starting point.** Usually the position of the aircraft at the airport is sufficient. The latitude/longitude can be obtained from the airport directory.

2. **Chain group repetition interval (GRI) with the best coverage for the survey area.** Each Loran-C chain is identified by its GRI and is available on Loran-C charts for a given coverage area.

The one with the best coverage of the survey area should be selected. The Southeast U.S. chain GRI is 7980, and the Northeast U.S. chain GRI is 9960.

3. **Secondary stations.** Two secondary stations must be selected to provide the best coverage for the survey area. Many Loran-C chains have more than two secondary stations from which you can choose the best coverage. Some Loran-C receivers automatically select the secondary stations that provide the best signal.

General Discussion

An experienced observer/tracker can be taught to program the Loran-C airborne system in one or two missions. After the system has been programmed and the survey is ready to be implemented, a variety of navigational data is computed.

A major advantage of Loran-C is the reduced time required to position the aircraft on a flight line prior to entering the survey area. Once on the flight line, the pilot can more accurately follow the desired line. The pilot is not required to make continual references to a flight map, thus, more attention can be directed to the flight path. This is an important safety factor. Members of the flight crew will experience less survey fatigue because they can concentrate fully on their job without the worry of visual navigational accuracy.

Loran-C can also aid in photographic surveys. The increased accuracy of following parallel flight lines provides greater control of sidelap, reducing the likelihood of gaps between photo lines. Sequential photography for sampling trends or loss assessment over time is not difficult when Loran is used.

An airborne Loran-C navigation system with prestored search patterns and a data link system costs about $30,000. A smaller system without the prestored search pattern and data link system costs $10,000. This expenditure, while substantial, is offset by savings in flight time and survey effectiveness.

There are other applications for the Loran-C navigation and position determination system. In forestry, these could include aerial applications of pesticides and fertilizers, spray block design, field plot location for forest surveys, transportation analysis, search and rescue operations, trail mapping for use in wildlife and migration studies, vehicle monitoring, and forest fire suppression. Fire control activities employing Loran-C could include locating the position of a fire, dispatching firefighters, airdropping retardants and supplies, and monitoring the locations of crew and equipment.

Additional information on this system can be obtained from Charles W. Dull, Forest Pest Management Survey Team, Northgate Office Park, Room 2103, 3620 Interstate 85, NE, Doraville, Ga. 30340 or telephone (404) 221-4796. This fact sheet summarizes information from Agricultural Handbook 567, **Loran-C Radio Navigation Systems as an aid to Southern Pine Beetle Surveys.**

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